CHAPTER **43**

USE OF POPLITEAL BLOCKS IN FOOT AND ANKLE SURGERY

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Regional anesthesia for foot and ankle surgery has been used extensively by podiatric surgeons for over thirty years.[1] In spite of a relatively steep learning curve for mastering the techniques, local anesthesia blocks at and below the ankle have remained popular and have been adopted widely by foot and ankle surgeons in general.[2-7] The majority of regional anesthesia has been provided by means of selective and combined peripheral nerve blocks and field blocks.

In general, regional anesthesia is ideal for ambulatory-type surgery, especially when combined with sub-hypnotic doses of sedatives to allay patient anxiety. The few disadvantages include the need for patient education and cooperation, time to institute the block(s), patient anxiety, and the effort necessary to acquire the skills. However, the advantages far outweigh the disadvantages. There are less risks with regional anesthesia when compared to general, spinal or caudal anesthesia. Fewer drugs with potential adverse effects are necessary, especially opioids. Although opioids have the advantages of a rapid onset of action, quick elimination, excellent analgesic and sedative properties and associated hemodynamic stability, they can also trigger a number of adverse effects including nausea and vomiting, respiratory depression, apnea, muscular rigidity and bradycardia. Regional anesthesia also has the advantages of improved postoperative pain control, more efficient use of surgical facilities and it is more economical requiring fewer drugs and reduced monitoring.

Regional blockage at the knee has been resurrected from obscurity, evaluated and analyzed in the literature during the past 15 years.[8-14] The two main uses for popliteal fossa block are as local regional anesthesia for foot, ankle, and leg surgery and for prolonged postoperative analgesia, although there has been limited use in the management of chronic pain syndrome.[15] The interest in this technique has been for use primarily in adults, however, more recently it has proven to be a useful and effective tool for prolonging postoperative analgesia in children.[16]

ANATOMY

The sciatic nerve is comprised of contributions from the L4 to S3 nerve roots. After it courses down the posterior thigh, the sciatic nerve passes deep to the adductors to enter the popliteal fossa. There it lies lateral to the midline and the more medial popliteal artery and vein.(Fig. 1)

The popliteal fossa is divided into a superior and inferior triangle by the transverse popliteal crease. The more proximal superior triangle is bordered medially by the semi-tendinous and semi-membranous muscles, and laterally by the biceps femoris muscle. Just above the apex of the superior triangle, the sciatic nerve divides at varying levels into the tibial nerve, which continues in the midline axis below the popliteal fossa, and the common peroneal nerve, which branches laterally to follow the tendon of the biceps femoris muscles to the lateral aspect of the knee. At that point, it winds around the fibular neck and into the anterior compartment of the leg. At the level of the sciatic

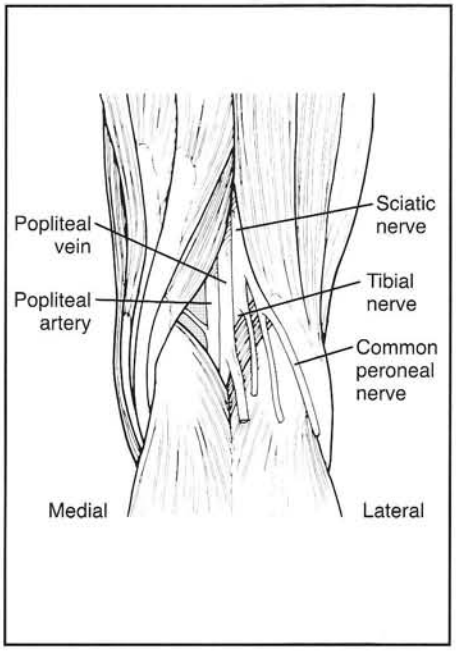

Figure 1. Anatomic drawing of popliteal fossa. Note that the sciatic nerve lies lateral to the midline as well as the popliteal artery and vein.

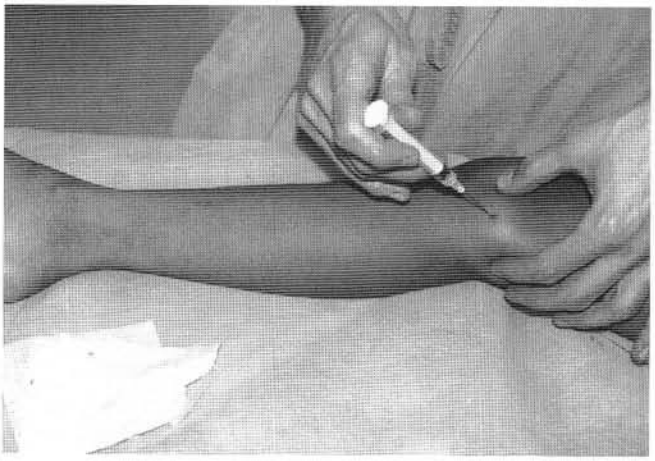

Figure 2. Location of the saphenous nerve as it arises along the medial knee between the tendons of the sartorius and gracilis muscles.

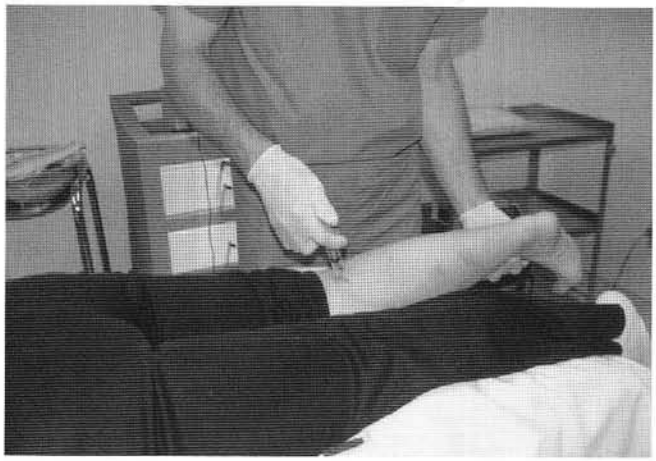

Figure 4. Technique of popliteal fossa block with the patient prone.

nerve bifurcation, the nerves are encased in a common epineurial sheath, so that injection of local anesthetic within the epineurial sheath results in the blockade of both nerve branches.[17]

Since the saphenous nerve has a different origin than the sciatic nerve, it must be anesthetized separately to complete a full regional blockade below the knee. It has contributions from L3 and L4 nerve roots and is actually a terminal branch of the femoral nerve. Because it arises from the adductor canal between the tendons of the sartorius and gracilis muscles at the medial aspect of the knee (Fig. 2) the saphenous nerve can be blocked at this point or by injecting just above and anterior to the medial malleolus where it courses beside the greater saphenous vein.

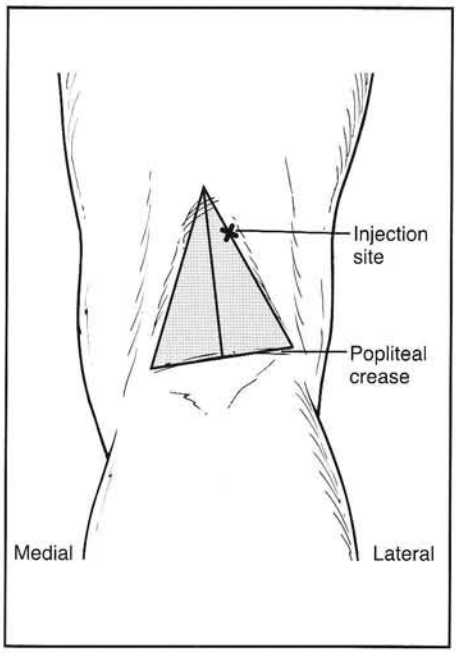

Figure 3. Drawing of superior triangle on skin of popliteal fossa. The point of injection is about 1 cm lateral to midline and 7 cm proximal to the popliteal crease.

NEURAL BLOCKADE TECHNIQUES

There are three basic approaches that can be used to achieve a popliteal fossa block - prone, supine or lateral. Each can be done with or without the use of a nerve stimulator to help locate the sciatic nerve. In the first two approaches, the superior triangle is drawn on the popliteal fossa using the popliteal crease to form the base of the triangle. The injection should be placed 1 cm lateral to the midline close to the apex of the superior triangle. (Fig. 3) Once proficiency has been achieved, it may not be necessary to use a nerve stimulator or to draw a triangle. There is a distinct "pop" which can be felt as the needle pierces the fascia into the popliteal fossa.[8,16,18] Lidocaine can be used to raise the wheal before needle placement, then 0.25-0.5% bupivacaine or 0.2% ropivacaine is injected with a 22 gauge 1½ inch short-bevel needle to achieve the block.

Prone Approach

One advantage of having the patient prone is that, if awake, the patient can be asked to flex the leg at the knee. This helps identify the tendon of the biceps femoris and other landmarks of the popliteal fossa. (Fig. 4) Also, the patient can respond to elicitation of a paresthesia to help identify correct

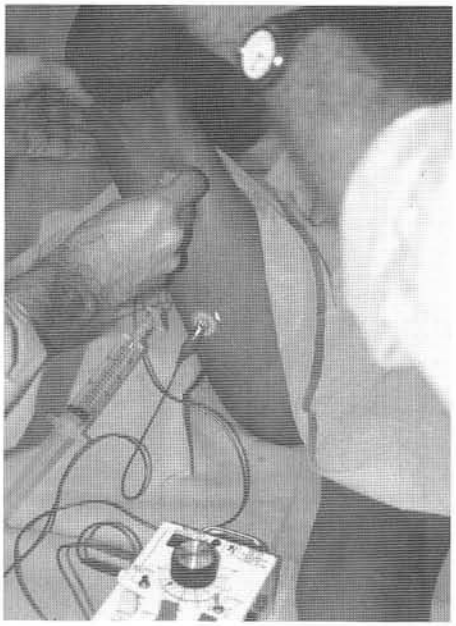

Figure 5. Placement of positive electrode while the needle-negative electrode probes proximal to superior fossa searching for the sciatic nerve to stimulate.

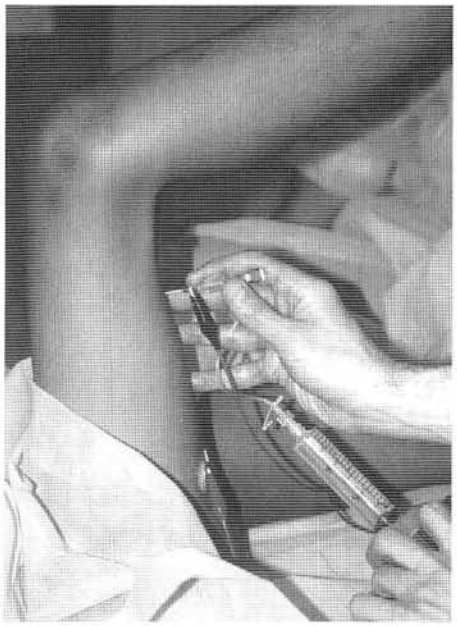

Figure 6. Infiltration of local anesthetic into the popliteal fossa.

needle placement. Once the site has been prepped, the superior triangle is drawn on the popliteal fossa. A vertical axis is drawn through the triangle, dividing it in half. A measurement is made along the midline axis 7 cm proximal from the popliteal crease, and 1 cm lateral.

If a nerve stimulator is used, a Teflon-sheathed 22 gauge insulated hypodermic needle attached to the negative lead is inserted and advanced toward the sciatic nerve. The positive lead is placed 5-10 cm from the injection site and the stimulator set at 1-3 mA with a twitch delivered every second (1 Hz). When a brisk visible muscle twitch is seen in the foot or leg, negative pressure is applied to make sure there is no intravascular penetration and a test dose of 1 to 2 ml of anesthetic infiltrated. Confirmation of correct placement is made when the twitching ceases. Then an additional 20 to 30 ml of anesthetic is injected about the nerve in the popliteal fossa.[8] (Fig. 5)

Supine Approach

The supine approach can be used in any patient, but it is particularly effective in the pediatric patient for postoperative analgesia. The block can be administered before the patient awakes precluding the need to turn the child prone The supine position facilitates flexion of the limb to 90 degrees at both the hip and the knee joints. The same superior triangle is marked on the skin of the popliteal fossa and the point of penetration measured to be over the sciatic nerve. The same technique described previously is used. A nerve stimulator may or may not be used, according to physician preference.[16]

Lateral Approach

Several authors have described a lateral approach to the popliteal fossa whereby the anesthesia can be administered with the patient supine.[9,19,20] The needle is advanced laterally into the popliteal fossa underneath the biceps femoris tendon using the same techniques already described to locate the sciatic nerve, where the anesthetic is delivered.

Successful blockade of the sciatic nerve in the popliteal fossa results in profound regional anesthesia distal to the block. The anesthesia can last 2 to 6 hours depending on the anesthetic agent used. Prolonged analgesia may last from 6 to 14 hours, averaging about 10 hours postoperatively. Other than occasional transient paresthesias which diminish over time, no adverse effects have been reported following popliteal fossa blocks.

DISCUSSION

There are few reported disadvantages to administering a popliteal fossa block. Theoretical concerns such as bleeding, vascular perforations or tears, and damage to nerve tissue have proven not to be a problem clinically. Transient postoperative paresthesias and patient anxiety can be minimized by thorough preoperative explanation to the patient. Anxiety can be further allayed through the use of a low-dose sedation as with midazolam plus a low-dose narcotic such as fentanyl or meperidine IM or IV.

The advantages of using the popliteal fossa block far outweigh the disadvantages. There is no significant sympathetic blockade high enough to effect cardiovascular changes or urinary retention. Unilateral anesthesia leaves one good contralateral limb and preserves ipsilateral hamstring function to permit crutch-walking. The excellent distal regional anesthesia allows the use of a midcalf pneumatic tourniquet when necessary for hemostasis. The minimal use of other pharmacologic agents avoids the complication of postoperative nausea and vomiting while dramatically reducing the risk of cardiovascular and pulmonary compromise. Prolonged postoperative analgesia decreases the need for opioids and their attendant side effects.

The economics of popliteal fossa block are remarkable as well. Less drug use allows earlier discharge. There is less need for anesthetic agents, narcotics and analgesics. Recovery time is minimal, requiring less need for personnel to monitor the patient very long in the recovery room. It is a procedure well-suited to the ambulatory surgery setting, resulting in excellent intraoperative anesthesia, prolonged postoperative analgesia, and high patient acceptance.

Popliteal fossa block for regional anesthesia and postsurgical analgesia is a safe and effective technique that can be mastered by surgeons and anesthesiologists for the benefit of foot and ankle surgery patients.

REFERENCES

1. Locke RK, Locke SE: Nerve blocks of the foot. *J Am Coll Emerg Phys* 5:698-702, 1976.
2. Sarrafian SK, Ibrahim IN, Breihan JH. Ankle-foot peripheral nerve-block for mid and forefoot surgery. *Foot Ankle* 4:86-90, 1983.
3. Greenberg CP: Practical, cost-effective regional anesthesia for ambulatory surgery. *J Clin Anesth* 7(7):614-621, 1995.
4. Hadzic A, Vloka JD, Kuroda MM, Koon R, Birnbach DJ: The practice of peripheral nerve blocks in the United States: A national survey. *Reg Anesth* 23(3):241-246, 1998.
5. Lee TH, Wapner KL, Hecht PJ, Hunt PJ: Regional anesthesia in foot and ankle surgery. *Orthopedics* 19:577-580, 1996.
6. Sharrock NE, Waller JF, Fierro LE: Midtarsal block for surgery of the forefoot. *Br J Anaesth* 58(1):7-40, 1986.
7. Myerson MS, Ruland CM, Allon SM: Regional anesthesia for foot and ankle surgery. *Foot Ankle* 13:282-288, 1992.
8. Hansen E. Eshelman MR, Cracchiolo III A: Popliteal fossa neural blockade as the sole anesthetic technique for outpatient foot and ankle surgery. *Foot Ankle Int* 21:38-44, 2000.
9. McLeod DH, Wong DHW, Claridg RJ, Merrick PM: Lateral popliteal sciatic nerve blocked compared with subcutaneous infiltration for analgesia following foot surgery. *Can J Anaesth* 41:673-676, 1944.
10. Rongsta K, Mann RA, Prieskoorn D. et al: Popliteal sciatic block for postoperative analgesia. *Foot Ankle Int* 17:378-82, 1996.
11. Rorie DK, Byer DE, Nelson DO, et al: Assessment of block of the sciatic nerve in the popliteal fossa. *Anesth Analg* 59:371-6, 1980.
12. Schimek F, Deusch H: New technique of sciatic nerve block in the popliteal fossa. *Eur J Anaesth* 12:163-169, 1995.
13. Sparks CJ, Higeleo T. Foot surgery in Vanuatu: results of combined tibial, common peroneal and saphenous nerve blocks in fifty-six adults. *Anaesth Intensive Care* 17:336-339, 1989.
14. Singelyn FJ, Gouverneur JM, Gribomont BF: Popliteal sciatic nerve block aided by a nerve stimulator: a reliable technique for foot and ankle surgery. *Reg Anesth* 16:278-281, 1991.
15. Singelyn FJ: Continuous femoral and popliteal sciatic nerve blockades. Techniques in regional anesthesia and pain management *Reg Anesth* 2(2):90-95, 1998.
16. Tobias JD, Mencio GA: Popliteal fossa block for postoperative analgesia after foot surgery in infants and children. *J Ped Orthop* 19:511-514, 1999.
17. Vloka JD, Hadzic A, Lesser JB, et al: A common epineural sheath for the nerves in the popliteal fossa and its implications for sciatic nerve block. *Anesth Anal* 84:387-90, 1997.
18. Singelyn FJ, Gouverneur JM, Gribomont BF: Popliteal sciatic nerve block aided by a nerve simulator: a reliable technique for foot and ankle surgery. *Reg Anesth* 16(5):278-81, 1991.
19. Vloka J, Hadzic A, Kitain E, Lesser JB, Kuroda M, April EW, Thys DM: Anatomical considerations of sciatic nerve block in the popliteal fossa through the lateral approach. *Reg Anesth* 21:414-418, 1996.
20. Zetlaoui PJ, Bouaziz H: Lateral approach to the sciatic nerve in the popliteal fossa. *Anesth Analg* 87:79-82, 1998.

ADDITIONAL REFERENCES

Collum CR, Courtney PG: Sciatic nerve block by a lateral approach to the popliteal fossa. *Anaesth Inten Care* 21A:237-238, 1993.

Gouverneur JM: Sciatic nerve block in the popliteal fossa with atraumatic needles and nerve stimulation. *Acta Anaesth Belg* 36:391-399, 1985.

Kilpatrick AWA, Coventry DM, Todd JG: A comparison of two approaches to sciatic nerve block. *Anaesthesia* 47:155-157, 1992.

Konrad C, Johr M: Blockade of the sciatic nerve in the popliteal fossa: a system for standardization in children. *Anesth Analg* 87(6):1256-1258, 1998.

Singelyn FJ, Aye F, Gouverneur JM: Continuous popliteal sciatic nerve block: an original technique to provide postoperative analgesia after foot surgery. *Anesth Angle* 84:383-386, 1997.

Tobias JD: Caudal epidural block with 0.125% bupivacaine for postoperative analgesia in children following lower extremity orthopedic procedures. *Am J Pain Manage* 7:89-91, 1997.

Vloka JD, Hadzic A, Mulcare R, Lesser JB, Kroon R, Thys DM: Combined blocks of the sciatic nerve at the popliteal fossa and posterior cutaneous nerve of the thigh for short saphenous vein stripping in outpatients: An alternative to spinal anesthesia. *J Clin Anesth* 9:618-622, 1997.